31-October-2020

CLEAN ENERGY SYSTEMS

The Power to Reverse Climate Change

David Albright
Manager, Groundwater Protection Section
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, California 94105

RE: Response to Technical Evaluation Comments and Information Request #2 for Underground Injection Control (UIC) Permit Application Class VI Pre-Construction Permit Application No. R9UIC-CA6-FY20-1

Dear Mr. Albright,

Clean Energy Systems, Inc. (CES) thanks you and the staff at the United States Environmental Protection Agency (EPA) for your consideration and review of our Class VI Pre-Construction Underground Injection Control Permit Application for the Mendota site. Please find the attached enclosures in response to your recent Technical Evaluation Comments and Information Request #2, dated 1-October-2020, covering the Emergency and Remedial Response Plan and Financial Responsibility Demonstration documents provided in the subject permit application as Attachments F and H, respectively. CES worked with technical experts at Schlumberger to develop the responses.

The first Enclosure addresses the EPA's comments on the Emergency and Remedial Response Plan. For completeness, we have included EPA's Enclosure and directly responded to information requests within the document, in *green font*. Additional information is provided in the Appendices.

The second Enclosure addresses the EPA's comments on the Financial Responsibility Demonstration. This Enclosure provides preliminary information only at this time. A follow-on response is planned once more detailed estimates can be generated for the site-specific Emergency and Remedial Response by an approved third-party and suitable financial instruments secured by the CES project. We anticipate completion of this in the fourth quarter of the calendar year (Q4 2020). CES appreciates your understanding and willingness to work with us on this matter.

To protect confidential business information (CBI), a version with CBI removed will be submitted through the EPA's online Geologic Sequestration (GS) Data Tool, while a second version, containing CBI, will be transmitted through a secure means to EPA.

If you have any questions related to the content of this response or wish to discuss these matters further, I can be reached via email at rhollis@cleanenergysystems.com.

Sincerely,

Rebecca M. Hollis
CES Director of Business Development – CNE

Enclosures

CC (via email): Keith Pronske, CES President & CEO
Natalie Nowiski, Schlumberger NE CCS BD and Legal Counsel
Vivian Rohrback, Schlumberger SIS Project Manager

ENCLOSURE 1

Evaluation of the Proposed Emergency and Remedial Response Plan for the CES-Mendota Class VI Project

EPA reviewed the proposed Emergency and Remedial Response Plan for the Clean Energy Systems (CES)-Mendota Class VI project (Attachment F of the permit application). EPA has the following questions and recommendations for CES.

Emergency Identification and Response Actions

For a holistic documentation of the response, EPA recommends that, for each scenario, the following be identified: severity of the impact: (i.e., high, medium, low); likelihood of the event; timing of the event (i.e., project phase); avoidance measures in place to reduce the likelihood of the event (e.g., maintenance or monitoring); detection methods that reflect planned testing and monitoring; response personnel; and equipment.

A separate risk register has been created that encompasses the recommended content listed above. The scenarios defined in the risk register align with what was initially defined in the proposed Emergency and Remedial Response Plan (ERRP) and incorporates EPA's recommendations, including additional scenarios that expand upon equipment failure.

The likelihood and severity were defined based upon knowledge of the area, previous project experience, and domain knowledge. A meeting was held amongst the team where consensus was reached as to the likelihood and severity levels. As the project progresses, the risk register will be updated to reflect the current risk scenarios and incorporate residual risk based upon the response plan.

The risk register, along with an updated ERRP is included in the Appendix.

EPA also recommends some additions/revisions to the descriptions of response actions for the specific scenarios identified in the plan. These are summarized in the table below:

A column entitled "CES Response" has been added to the table below to ensure that the EPA's comment/recommendation has been addressed by incorporating into either the ERRP and/or the risk register.

Event/Scenario	EPA Comment/Recommendation	CES Response
All	Add: "Limit access to wellhead to authorized personnel only."	*Incorporated*
Well Integrity Failure	Response actions could also include: "If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components."	*Incorporated*
Injection Well Monitoring Equipment Failure	Expand this scenario to include other equipment failures and damage to the wellhead.	*Incorporated. Please refer to risk register.*
Injection Well Monitoring Equipment Failure	Response actions could also include: • Evaluate the cause of the failure, and mitigate if necessary (i.e., repair equipment). • If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased. • Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	*Incorporated*
Injection Well Monitoring Equipment Failure	Response actions for a Major or Serious emergency could also include: • Review downhole, wellhead, and annulus pressure data. • Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor. • Perform a well log/MIT to detect CO_2 movement outside of the casing.	*Incorporated*
Potential Brine or CO_2 Leakage to USDW	This scenario should encompass: any evidence of CO_2 or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO_2 leakage to the land surface.	*Incorporated. Please refer to risk register.*
Potential Brine or CO_2 Leakage to USDW	CES should identify what types of activities they plan to perform to determine the severity of the event, e.g., sampling, pressure falloff test, Hall Plot analysis.	*Incorporated. Please refer to risk register.*
Potential Brine or CO_2 Leakage to USDW	Other appropriate steps may include: • Address a well integrity issue, including taking specific steps to identity the location of the failure/leak, affect repairs, and demonstrate MI. • Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	*Incorporated*
Natural Disaster	Add to the responses to a minor emergency: "If there has not been a loss of mechanical integrity, initiate gradual shutdown."	*Incorporated*
Induced Seismic Event	This section and the title should refer to induced or natural seismic events.	*Incorporated*
Induced Seismic Event	Please explain how the selected seismic thresholds (i.e., magnitude, distance from the project) are considered to be protective of USDWs.	*With an event inside the plume > 2, (or more than five > 1.5 in 30 days), the site operator will stop injection and run a pressure fall-off test to determine if containment has been breached.*

Event/Scenario	EPA Comment/Recommendation	*CES Response*
Induced Seismic Event	In the green operating state: add "Document the event for reporting to EPA in semiannual reports."	*Incorporated*
Induced Seismic Event	At the yellow, orange, and magenta operating states, add: "Initiate gradual shutdown of the well if it is determined to be appropriate."	*Incorporated*
Induced Seismic Event	Recommended edits to item 6 of the magenta and red operating states: • Determine if leaks to ground water or surface water or a CO_2 leak to the surface occurred. • If a CO_2 leak or USDW contamination/endangerment is detected: a. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultation with the Director.	*Incorporated*
Induced Seismic Event	Please describe the "rate reduction plan" in the response to the magenta operating state. Does this refer to gradual shutdown?	*The rate reduction plan is the same as gradual shutdown.*
Induced Seismic Event	In the red operating state, item 1: "Initiate immediate shutdown plan."	*Incorporated*

Response Personnel and Equipment

- Is the phone number for the control room technician on duty a 24-hour number? If not, please provide one.

Yes, the phone number for the control room technician on duty is a 24-hour number.

- Please include contact information (name, 24-hour number, and email address) for the plant manager.

Plant Safety Manager - Clint Cooper: Off: (559) 655-3947, 24 hr: 559-916-2139

Staff Training and Exercise Procedures

- Please provide a copy of CES's site specific standard operating procedures and training program

Site specific standard operating procedures (SOPs) and training programs are still under development for the Mendota Project. They are being built upon those for the existing, idled biomass power facility. When operational, the power plant had nearly 100 SOPs and 50 safety procedures. The facility earned "STAR" status from the California Division of Occupational Safety and Health (Cal/OSHA) under the Voluntary Protection Program (Cal/VPP) — a program designed to recognize employers and employees who have implemented safety and health programs that go beyond minimal Cal/OSHA standards and provide the best feasible protection at the site[1]. CES expects to continue the commitment to safety and employee participation in order to maintain leadership in the field of workplace safety and health.

[1] State of California Department of Industrial Relations, Cal/OSHA, California Voluntary Protection Program, https://www.dir.ca.gov/dosh/cal_vpp/cal_vpp_index.html, accessed October 30, 2020

For reference only, CES has included in the Appendix the Employee Safety Orientation and Emergency Action Plan for the idled biomass power facility. Note these will be updated for the Clean Energy Systems carbon capture and storage facility.

CES is working with Schlumberger on the design and development of the CO2 storage well. If Schlumberger is awarded the work, standard health, safety, and environment (HSE) practices will be applied as well as SOPs and training programs. For reference, a copy of the Project HSE Management guide describing the necessary governance documents is included in the Appendix, as well as a Standard Personnel Certification for integrated well construction (IWC). Additional information such as: Casing and Corrosion Log EMIT XLD Service Delivery FE FS SWI, Wireline Cased Hole Fluid and Pressure and Testing Standard Work Instruction and Wireline Pulsed Neutron Operations, is available upon request.

- Will the ERRP be incorporated into a site safety plan as well? If so, please include.

Yes, the ERRP will be included in the site-specific safety plan. As noted above, the site specific plans are still under development but a sample of the idled biomass power facility's Emergency Action Plan is included in the Appendix for reference only.

Appendices

- Attachment F: Emergency and Remedial Response Plan, Rev. 1.1, 26-Oct-2020
- Preliminary Risk Register

The following content has been removed from this document as they contain Confidential Business Information. These documents will be sent directly to the EPA.

- Mendota Employee Safety Orientation, Expired; For Reference Only
- Mendota Emergency Action Plan, Expired; For Reference Only
- Project HSE Management, Project HSE Governance Documents
- IWC Personnel Certification Standard, Doc No. IWC-PM-ST-003

ATTACHMENT F: EMERGENCY AND REMEDIAL RESPONSE PLAN 40 CFR 146.94(a)

CLEAN ENERGY SYSTEMS MENDOTA

1. Facility Information

Facility name:	CLEAN ENERGY SYSTEMS MENDOTA MENDOTA_INJ_1
Facility contact:	Rebecca Hollis 400 Guillen Pkwy, Mendota, CA 93640 Office: 916-638-7967
Well location:	MENDOTA, FRESNO COUNTY CA LAT/LONG COORDINATES (36.75585015/-120.36440423)

This Emergency and Remedial Response Plan (ERRP) describes actions that Clean Energy Systems shall take to address movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods.

If Clean Energy Systems obtains evidence that the injected CO_2 stream and/or associated pressure front may cause an endangerment to a USDW, Clean Energy Systems must perform the following actions:

1. Initiate shutdown plan for the injection well.
2. Take all steps reasonably necessary to identify and characterize any release.
3. Notify the permitting agency (UIC Program Director) of the emergency event within 24 hours.
4. Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, the following protocol will be employed: Clean Energy Systems will immediately cease injection. However, in some circumstances, Clean Energy Systems will, in consultation with the UIC Program Director, determine whether gradual cessation of injection (using the parameters set forth in Attachment A of the Class VI permit) is appropriate.

This attachment is one of the several documents listed below that was prepared by Schlumberger and delivered to Clean Energy Systems. These documents were prepared to support the Clean Energy Systems preconstruction application to the EPA.

- (Schlumberger, Attachment A: Summary of Requirements Class VI Operating, 2020)
- (Schlumberger, Attachment B: Area of Review and Corrective Action Plan, 2020)
- (Schlumberger, Attachment C: Testing and Monitoring Plan, 2020)
- (Schlumberger, Attachment D: Injection Well Plugging Plan, 2020)

- (Schlumberger, Attachment E: Post-Injection Site Care and Site Closure Plan, 2020)
- (Schlumberger, Attachment F: Emergency and Remedial Response Plan, 2020)
- (Schlumberger, Attachment G: Construction Details Clean Energy Systems Mendota, 2020)
- (Schlumberger, Attachment H: Financial Assurance Demonstration, 2020)
- (Schlumberger, Class VI Permit Application Narrative, 2020)
- (Schlumberger Quality Assurance and Surveillance Plan, 2020)

Contents

1.1 Acronyms and Abbreviations

*: Denotes a Mark of Schlumberger

AoR: Area of review

BFS: Base of fresh water

BGS: Below ground surface

CCS: Carbon capture and storage

CEMA: California Emergency Management Agency

CES: Clean Energy Systems

CNE: Carbon negative energy

DFN: Discrete fracture network

DST: Drill stem test

DT: Compressional slowness

DTS: Distributed temperature sensing

EPA: Environmental Protection Agency

FMI: Formation microimager

GRFS: Gaussian random function simulation

GR: Gamma ray

GS: Geological sequestration

KH: Permeability thickness

KINT: Permeability

Mendota_INJ_1: Proposed CO_2 Injection Well

MIT: Mechanical integrity test

MWD: Measurement while drilling

NPHI: Neutron porosity

PISC: Post injection Site Care

PHIT: Total porosity

PIGE: Effective porosity

RHOB: Bulk density

Rwa: Formation water resistivity

SGR: Shale gouge ratio

Shmax: maximum horizontal stress

Shmin: minimum horizontal stress

SP: Spontaneous potential

USDW: Underground sources of drinking water

VCL: Volume clay

VSP: Vertical Seismic profile

Vp/Vs: Compressional to shear velocity ratio

XRD: X-Ray diffraction analysis

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2. Local Resources and Infrastructure

Based upon EPA's Technical Evaluation Comments and Information Request #2 for Underground Injection Control (UIC) Permit Application Class VI Pre-Construction Permit Application No. R9UIC-CA6-FY20-1 dated October 1, 2020, the yellow highlighted sections have been incorporated as per EPA's request.

Resources in the vicinity of the Clean Energy Systems Mendota that may be affected as a result of an emergency event at the project site include:

- Underground sources of drinking water, or USDW's and water wells within the AoR. There are approximately 67 water supply wells, monitoring wells and water wells abandoned wells within the AoR (red polygon Figure 1). A map displaying the locations of these wells can be found in the (CLASS VI PERMIT APPLICATION NARRATIVE 40 CFR 146.82(a) Clean Energy Systems Mendota, 2020). The location of these wells is not accurate because they were originally reported in a legal land description format; therefore, they all plot in the middle of a section and line up in an organized grid pattern (California Department of Water Resources, n.d.). In future phases of this project, accurate locations of these water wells will be provided. The deepest USDW is the Santa Margarita formation at depth of approximately 1,400 ft. The San Joaquin River flows north south and is 0.6 miles due east of the site. The northern boundary of the Mendota Wildlife Area is 1.7 miles to the south. Managed by the California Department of Fish and Wildlife. The Mendota Wildlife Area is approximately 11,800 acres consisting of flatlands and floodplain.

Infrastructure in the vicinity of the Clean Energy Systems Mendota that that may be affected as a result of an emergency at the project site include:

- The town of Mendota, CA is west of the site. Mendota is a town in Fresno County. The population was 11,014 at the 2010 U.S. Census. It covers 3.3 square miles and has approximately 2,750 households. The nearest residence to the site is 0.5 miles west and outside the AoR. Mendota is located 8.5 miles south-southeast of Firebaugh, at an elevation of 174 feet. Between the site and the town are several businesses, including Gonzales Transport and airstrip (1,500') west. There is also the King Kool cold storage facility and Oro Loma Ranch/Ruby Fresh, a pomegranate marketing firm. Mendota High School is 0.7 miles south-west. The North Star solar facility borders on the north of the site and is a 61-megawatt facility is located on 626 acres.

Resources and infrastructure addressed in this plan are shown in Figure 1.

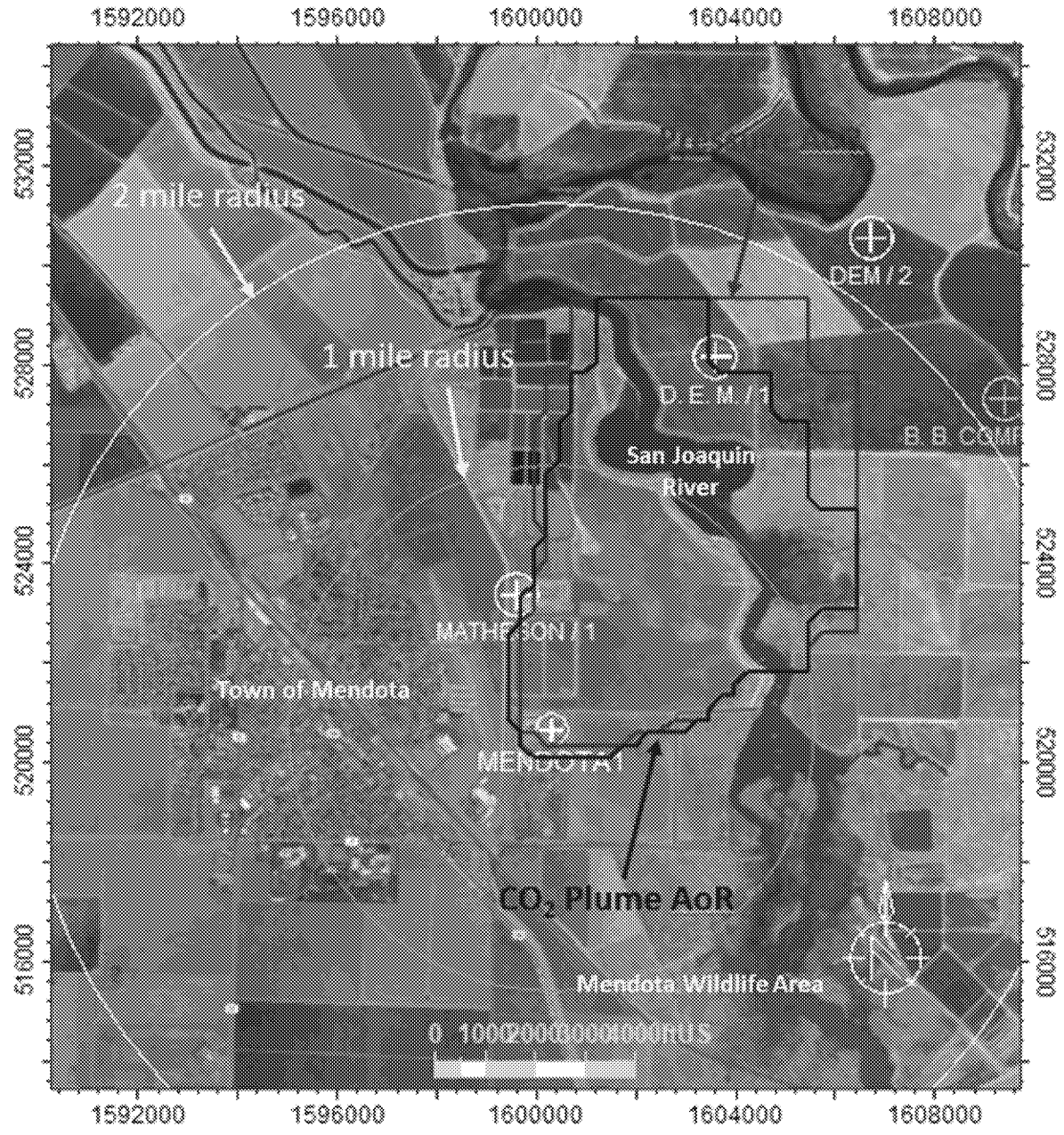

Figure 1. Map of the site resources and infrastructure

3. Potential Risk Scenarios

The following events related to the Clean Energy Systems Mendota that could potentially result in an emergency response:

- Over-pressurized fluid (blowout) during well construction;
- Injection or monitoring (verification) well integrity failure;

- Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.);
- A natural disaster (e.g., earthquake, tornado, lightning strike);
- Fluid (e.g. brine) leakage to a USDW;
- CO_2 leakage to USDW or to land surface; or
- Induced seismic event.

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in Table 1.

Table 1. Degrees of risk for emergency events.

Emergency Condition	Definition
Major emergency	Event poses immediate substantial risk to human health, resources, or infrastructure. Emergency actions involving local authorities (evacuation or isolation of areas) should be initiated.
Serious emergency	Event poses potential serious (or significant) near term risk to human health, resources, or infrastructure if conditions worsen or no response actions taken.
Minor emergency	Event poses no immediate risk to human health, resources, or infrastructure.

4. Emergency Identification and Response Actions

Steps to identify and characterize the event will be dependent on the specific issue identified, and the severity of the event. The potential risk scenarios identified in Part 2 are detailed below.

4.1 Over-pressurized fluid (blowout) during well construction

This event could occur during well drilling or some, if a pocket of high-pressure gas or fluid is encountered resulting in a sudden release:

- Cease operations:
  - Loss of well control due to inadequate barrier in place or human error.
  - Drilling into an over-pressured formation or improper well control initiated during maintenance or workover process.

Response actions:

- Close flow valve (blowout preventer) if pressures and flows permit, at a minimum vent to a controlled area.
- Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke or both.
- For a Major or Serious emergency:
    - Initiate well control procedures (see well plan).
    - Alert local fire and police and UIC Program Director immediately.
- For a Minor emergency:
    - Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke or both.
    - Determine cause of event and initiate remediation procedures.
    - Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).

4.2 Well Integrity Failure

Integrity loss of the injection well and/or verification well may endanger USDWs. Examples of well integrity failure may include scenarios related to wellhead pressure, annulus pressure, mechanical integrity, and failure of monitoring equipment. For further details please refer to Risk Register scenario numbers 2a, 2b, and 2c.

Integrity loss may have occurred if the following events occur:

Scenarios:

1. Wellhead pressure exceeds the specified shutdown pressure specified in the permit.
2. Annulus pressure indicates a loss of external or internal well containment
3. Mechanical integrity test results identify a loss of mechanical integrity

- Limit access to wellhead to authorized personnel only.
- Automatic shutdown devices are activated:
    - Wellhead or downhole pressures exceeds the specified shutdown pressure specified in the permit.
    - Annulus pressure and/or fluid volumes indicate a loss of external or internal well containment.

  - Pursuant to 40 CFR 146.91(c)(3), Clean Energy Systems must notify the UIC Program Director within 24 hours of any triggering of a shut-off system (i.e., down-hole or at the service).

- Mechanical integrity test results identify a loss of mechanical integrity.

Response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a Major or Serious emergency (verified loss or increase of pressure or fluid volumes and/or loss of mechanical integrity during testing and maintenance):
  - Initiate immediate shutdown plan.
  - Shut in well (close flow valve). After verifying pressures, with analog gauges, to confirm no damage will occur to the well or USDW.
  - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - Vent fluids, if necessary, from wellhead in order to maintain acceptable pressures at surface and downhole in order not to damage the wellhead or casing.
  - Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
  - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - Identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.
  - Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
  - Review downhole, wellhead, and annulus pressure data.
  - Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.
  - Perform a well log/MIT to detect CO2 movement outside of the casing.
- For a Minor emergency (downhole and surface sensor/monitoring equipment failure, procedural maintenance error or plant issue) :
  - Initiate immediate shutdown plan.

- Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; use analog gauges to identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
- If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components, electrical malfunctions without endangering a USDW, repair faulty components
- Review downhole, wellhead, and annulus pressure data.
- Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
- If contamination is detected or well integrity has been determined to have occurred, then situation becomes a Major or Serious emergency. Refer to Major or Serious solutions above.

4.3 Injection Well Monitoring Equipment Failure

The failure of monitoring equipment for wellhead/downhole pressure, temperature, and/or acoustics may indicate a problem with the injection well that could endanger USDWs. Additionally, equipment failures (sensor, computer, cabling, etc) and damage to the wellhead could endanger the USDW. For further details please refer to Risk Register scenario numbers 3a and 3b.

Response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For a Major or Serious emergency (failure of sensors that will require shutdown of well to repair, requires extended repair time (>48hrs) and/or well reentry to fix problem):
  - Initiate immediate shutdown plan.
  - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - Review downhole and wellhead pressure, temperature & acoustic data.
  - Evaluate pressures and conditions via analog gauges to determine no damage to wellbore, wellhead or USDW will occur.
  - Shut in well (close flow valve or allow packer fluid into reservoir, fill hole).
  - Vent fluids from wellbore & surface facilities.

- Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
- Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
- If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
- Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.
- Perform a well log/MIT to detect CO2 movement outside of the casing.

- For a Minor emergency: (sensor or monitoring failure that does not require shutdown of well to repair)
  - Monitor well pressure, temperature, and acoustics to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, continue shutdown plan and refer to Major or Serious emergency guidelines.
  - Reset automatic shutdown devices.
  - Evaluate the cause of the failure, and mitigate if necessary (i.e., repair equipment).
  - Confirm well integrity prior to restarting injection and upon approval of the UIC Program Director.

4.4 Potential Brine or CO_2 Leakage to USDW

Elevated concentrations of indicator parameter(s) in groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage into a USDW. This scenario will encompass any evidence of CO2 or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO2 leakage to the land surface. For further details please refer to Risk Register scenario numbers 4a and 4b.

Elevated concentrations of indicator parameter(s) in groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage into a USDW. To better protect the USDW and to have an early warning system for USDW impact, it is important to monitor out of zone CO_2 migration above the stroarge complex. This scenario will encompass any evidence of CO_2 or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated

with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO_2 leakage to the land surface. The technology that is planned to be used to identify and quantify the severity of a potential brine or CO_2 leakage to USDW is described in the (Schlumberger, Attachment C: Testing and Monitoring Plan, 2020).

Response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For all emergencies (Major, Serious, or Minor):
    - Initiate shutdown plan.
    - If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:
        - Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and
        - Remediate unacceptable impacts to the affected USDW.
    - Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.
    - Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or CO2, or "pump and treat" to aerate CO2-laden water).
    - Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.
    - If there is a well integrity issue specific steps will be taken to identify the location of the failure/leak, affect repairs, and demonstrate mechanical intergrity.
    - If the leak posses a risk to air quality the nearby area will be isolated and a safe distance and perimeter will be established a using a hand-held air-quality monitor.

4.5 Natural Disaster

Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. An earthquake may disturb surface and/or subsurface facilities; and weather-related disasters (e.g., tornado or lightning strike) may affect surface facilities. For further details please refer to Risk Register scenario number 5a.

If a natural disaster occurs that affects normal operation of the injection well, perform the following:

Response actions:

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- Limit access to wellhead to authorized personnel only.
- For a Major or Serious emergency:
    - Initiate immediate shutdown plan. Shut in well (close flow valve).
    - Vent CO2 from surface facilities if appropriate.
    - Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.
    - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).
    - Determine if any leaks to ground water or surface water occurred.
    - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).
- For a Minor emergency:
    - Conduct assessment to determine whether there has been a loss of mechanical integrity.
    - If there has been a loss of mechanical integrity, initiate shutdown plan.
    - If there has not been a loss of mechanical integrity, initiate gradual shutdown.
    - Shut in well (close flow valve).
    - Vent CO2 from surface facilities if appropriate.
    - Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).

4.6 Induced or Natural Seismic Event

Based on the project operating conditions, it is highly unlikely that injection operations would ever induce a seismic event at all. Simulations show extremely small pressure increase produced by the planned injection into the Second Panoche formation. Therefore, this portion of the response plan is developed for any seismic event with an epicenter within a 0.5-mile radius of the injection well.

To monitor the area for seismicity, an optical cable will be installed in the Above Confining Zone monitor well (Mendota_ACZ_1) with Digital Acoustic (DAS). The DAS fiber cable will monitor continuously and be recorded by a surface recording system. The recording system will be programed to identify induced seismic events in real time and is programed to automatically send alerts to site safety personnel.

Based on the periodic analysis of the monitoring data, observed level of seismic activity, and local reporting of felt events, the site will be assigned an operating state. The operating state is determined using threshold criteria which correspond to the site's potential risk and level of seismic activity. The operating state provides operating personnel information about the potential risk of further seismic activity and guides them through a series of response actions.

The seismic monitoring system structure is presented in *Table **2***. The table corresponds each level of operating state with the threshold conditions and operational response actions. For further details please refer to Risk Register scenario numbers 6a, 6b, 6c, 6d and 6e.

Table 2. Seismic monitoring system, for seismic events > M1.0 with an epicenter within a 0.5-mile radius of the injection well.

Operating State	Threshold Condition[1,2]	Response Action[3]
Green	Seismic events less than or equal to M1.5	1. Continue normal operation within permitted levels. 2. Document the event for reporting to EPA in semiannual reports.
Yellow	Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0	1. Continue normal operation within permitted levels. 2. Initiate gradual shutdown of the well if it is determined to be appropriate. 3. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 4. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event. 5. Document the event for reporting to EPA in semiannual reports.
Orange	Seismic event greater than M1.5 and local observation or felt report Seismic event greater than M2.0 and no felt report	1. Continue normal operation within permitted levels. 2. Initiate gradual shutdown of the well if it is determined to be appropriate. 3. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 4. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event. 5. Report findings to the UIC Program Director and issue corrective actions. 6. Document the event for reporting to EPA in semiannual reports.

[1] Specified magnitudes refer to magnitudes determined by local Clean Energy Systems or USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.

[2] "Felt report" and "local observation and report" refer to events confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.

[3] Reporting findings to the UIC Program Director and issuing corrective action will occur within 25 business days (five weeks) of change in operating state.

Operating State	Threshold Condition[1,2]	Response Action[3]
Magenta	Seismic event greater than M2.0 and local observation or report	1. Initiate gradual shutdown of the well if it is determined to be appropriate. 2. Within 24 hours of the incident, notify the UIC Program Director, of the operating status of the well. 3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 4. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 5. Determine if leaks to ground water or surface water or a CO_2 leak to the surface occurred. 6. If a CO_2 leak or USDW contamination/endangerment is detected: a. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director. 7. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event. 8. Report findings to the UIC Program Director and issue corrective actions. 9. Document the event for reporting to EPA in semiannual reports.
Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage[4]	1. Initiate immediate shutdown plan. 2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well.

[4] Onset of damage is defined as cosmetic damage to structures, such as bricks dislodged from chimneys and parapet walls, broken windows, and fallen objects from walls, shelves, and cabinets.

Operating State	Threshold Condition[1,2]	Response Action[3]
	Seismic event >M3.5	3. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 4. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 5. Determine if leaks to ground water or surface water or a CO_2 leak to the surface occurred. 6. If a CO_2 leak or USDW contamination/endangerment is detected: a. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director. 7. Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event. 8. Report findings to the UIC Program Director and issue corrective actions. 9. Document the event for reporting to EPA in semiannual reports.

5. Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ERRP.

Site personnel to be notified (not listed in order of notification):

1. Emergency Coordinator - Control Room technician on Duty: 559-655-4923
2. Plant Safety Manager - Clint Cooper: Off: (559) 655-3947, 24 hr: 559-916-2139
3. Alt Facility Emergency Coord.: Arnold Gonzales: Office: (559) 655-4921 x12 Mobile: (559) 916-2142
4. Plant Manager

A site-specific emergency contact list will be developed and maintained during the life of the project. Clean Energy Systems will provide the current site-specific emergency contact list to the UIC Program Director.

Table 3. Contact information for key local, state, and other authorities.

Agency	**Phone Number**
Local police	911
Mendota Fire Department	911
Ambulance/Paramedics	911
Fresno Community Regional Medical Center	24 hr 559-459-6000
Poison Control Center	800-342-9293
California Office of Emergency Services	24 hr 800-852-7550
State Water Quality Control Board (Central Valley)	916-255-3000
Environmental services contractor - Schlumberger	661-864-4700
UIC Program Director	Not yet assigned
EPA National Response Center (24 hours)	800-424-8802
State geological survey	916-322-1080

Equipment needed in the event of an emergency and remedial response will vary, depending on the triggering emergency event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a drilling rig or logging equipment) is required, Clean Energy Systems shall be responsible for its procurement.

6. Emergency Communications Plan

Clean Energy Systems will communicate to the public about any event that requires an emergency response to ensure that the public understands what happened and whether there are any environmental or safety implications. The amount of information, timing, and communications method(s) will be appropriate to the event, its severity, whether any impacts to drinking water or other environmental resources occurred, any impacts to the surrounding community, and their awareness of the event.

Clean Energy Systems will describe what happened, any impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. For responses that occur over the long-term (e.g., ongoing cleanups), Clean Energy Systems will provide periodic updates on the progress of the response action(s).

Clean Energy Systems will also communicate with entities who may need to be informed about or take action in response to the event, including local water systems, CO2 source(s) and pipeline operators, landowners, and Regional Response Teams (as part of the National Response Team).

7. Plan Review

This ERRP shall be reviewed:

- At least once every five (5) years following its approval by the permitting agency;
- Within one (1) year of an area of review (AOR) reevaluation.
- Within 30 days, or other time prescribed by the EPA Director, following any significant changes to the injection process or the injection facility, or an emergency event; or
- As required by the permitting agency.

If the review indicates that no amendments to the ERRP are necessary, Clean Energy Systems will provide the permitting agency with the documentation supporting the "no amendment necessary" determination.

If the review indicates that amendments to the ERRP are necessary, amendments shall be made and submitted to the permitting agency within 30 days, or other time prescribed by the EPA Director, following an event that initiates the ERRP review procedure.

8. Staff Training and Exercise Procedures

CES will integrate the ERRP into the storage site specific standard operating procedures and training program.

- Periodic training will be provided, not less than annually

- Training will be provided to well operators, plant safety and environmental personnel, the plant manager, plant superintendent, and corporate communications. The training plan will document that the above listed personnel have been trained and possess the required skills to perform their relevant emergency response activities described in the ERRP.

9. References

California Department of Water Resources. (n.d.). Retrieved from water.ca.gov/Library/Other-DWR-Portals

(2019). *CLASS VI PERMIT APPLICATION NARRATIVE 40 CFR 146.82(a) Clean Energy Systems Mendota.* CES.

Schlumberger Quality Assurance and Surveillance Plan. (2020). *Quality Assurance and Surveillance Plan.*

Schlumberger, Attachment A: Summary of Requirements Class VI Operating. (2020). *Attachment A: Summary of Requirements Class VI Operating and Reporting Conditions.*

Schlumberger, Attachment B: Area of Review and Corrective Action Plan. (2020). *Attachment B: Area of Review and Corrective Action Plan 40 CFR 146.84(b) Clean Energy Systems Mendota.*

Schlumberger, Attachment C: Testing and Monitoring Plan. (2020). *Attachment C: Testing and Monitoring Plan 40 CFR 146.90 Clean Energy Systems Mendota.*

Schlumberger, Attachment D: Injection Well Plugging Plan. (2020). *Attachment D: Injection Well Plugging Plan 40 CFR 146.92(B) Clean Energy Systems Mendota.*

Schlumberger, Attachment E: Post-Injection Site Care and Site Closure Plan. (2020). *Attachment E: Post-Injection Site Care and Site Closure Plan 40 CFR 146.93(A) Clean Energy Systems Mendota.*

Schlumberger, Attachment F: Emergency and Remedial Response Plan. (2020). *Attachment F: Emergency and Remedial Response Plan 40 CFR 146.94(A) Clean energy Systems Mendota.*

Schlumberger, Attachment G: Construction Details Clean Energy Systems Mendota. (2020). *Attachment G: Construction Details Clean Energy Systems Mendota.*

Schlumberger, Attachment H: Financial Assurance Demonstration. (2020). *Attachment H: Financial Assurance Demonstration 40 CFR 146.85 Clean Energy Systems Mendota.*

Schlumberger, Class VI Permit Application Narrative. (2020). *Class VI Permit Application Narrative 40 CFR 146.82(A) Clean Energy Systems Mendota.*

Preliminary Risk Register

The likelihood and severity were defined based upon knowledge of the area, previous project experience, and domain knowledge.
A meeting was held amongst the team where consensus was reached as to the likelihood and severity levels.
As the project progresses, the risk register will be updated to reflect the current risk scenarios and incorporate residual risk based upon the response plan.
When reviewing the scenario the highest risk level was assigned.

Scales of Severity and Likelihood (probability)

Risk is evaluated as Severity times Likelihood, S*L. **S** and **L** are each evaluated on a 5-point scale, so Risk level ranges from 1 to 25.

For each scenario, we evaluate Severity first, and then judge the Likelihood that negative impacts of that Severity will occur.

All these scales are semi-quantitative; pick the Ranking Factor using either the words or the numerical descriptions, whichever is the most applicable for the scenario.

Ranking Factor	Severity of Negative Impact (S)	
5	**Multi-Catastrophic**	Multiple fatalities and/or damages exceeding $100M and/or project shut down.
4	**Catastrophic**	One fatality and/or damages $10M-$100M and/or project lost time greater than 1 year.
3	**Major**	Injury causing permanent disability and/or damages exceeding $1M to $10M and/or project lost time greater than 1 month and/or permit suspension and/or area evacuation.
2	**Serious**	Injury causing temporary disability and/or damages $100k to $1M and/or project lost time greater than 1 week and/or regulatory notice.
1	**Light**	Minor injury or illness and/or damages less than $100k and/or project lost time less than 1 week.

Ranking Factor	Likelihood of Impact or Failure Occurring (L)	
5	**Very High**	Scenario occurs every few years, or more often. Nearly certain to happen during the project.
4	**High**	Scenario occurs every few decades. Probably will happen during the project.
3	**Medium**	Scenario occurs every century.
2	**Low**	Scenario occurs every few centuries.
1	**Very Low**	Scenario unlikely to occur.

Risk Level	
Black	**Extreme:** Stop the tasks/processes. Significant Action Plan required.
Red	**High:** Significant Action Plan required.
Yellow	**Medium:** Action Plan required.
Green	**Low:** Proceed carefully. Action Plan may but warranted but not required.
Blue	**Insignificant:** Safe to proceed. Action Plan not required.

CES Project Preliminary Risk Register

Risk Level	
Black	Extreme: Stop the tasks/processes. Significant Action Plan required.
[illegible]	High: Significant Action Plan required.
Yellow	Medium: Action Plan required.
[illegible]	Low: Proceed carefully. Action Plan may but w arranted but not required.
[illegible]	Insignificant: Safe to proceed. Action Plan not required.

Client: Clean Energy Systems (CES)
Project Name: NAM-NAL_RCG_SIS_USCL_CES_ Preliminary EPA UIC Class VI Permit for 6 sites 2019-2020
Project Id: 2019-PRJ-0553
Contract Number: 1-1K8MBPT

Text higlighted in yellow has been added based upon EPA's recommendations.

Identification								Qualitative Analysis			Risk Response								
Risk Number	Date Identified	Identified By	Project Phase	Description of Risk	Risk Trigger(s)	Risk Type	Risk Category	Likelihood	Severity	Risk Metrix	Strategy	Strategy Action Plan/Response Plan	Category	Assigned to	Avoidance Measures	Response Personnel	Equipment	Status	Risk Number
1a		SLB	Drilling	Over-pressurized fluid (blowout) during well construction	1. Pocket of high pressure gas or fluid encountered during drilling.	Drilling	HS	Very Low	Catastrophic	X (Likelihood: Very Low; Severity: Catastrophic)	Mitigation	Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator			1a
											Mitigation	Cease drilling operations: loss of drilling fluid due to lost circulation and/or drilling into an over-pressured formation.	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Initiate well control procedures (see well plan).	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pressure Control equipment	Open	
											Mitigation	Close flow valve (blowout preventer) if considered appropriate not to damage well and USDW.	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Regain pressure control by restoring fluid levels in the wellbore with appropriate density mud, restriction of flow through choke or both.	Major/Serious/Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pumping Equipment, Rig	Open	
											Mitigation	Alert local fire and police and UIC Program Director immediately.	Major/Serious	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Determine cause of event and initiate remediation procedures.	Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.	Pumping Equipment, Rig	Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Well Eng.	Monitoring	Well Eng., Project Mgr.		Open	
2a		SLB	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Wellhead pressure exceeds the specified shutdown pressure specified in the permit.	Equipment	HS	Low	Light	X (Likelihood: Low; Severity: Light)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	2a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.	Major/Serious, Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline	Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause, location and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Eng	Monitoring	Well Eng	Wireline logs, workover rig	Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Evaluate, test sensors to determine they are functioning properly. If sensors are determined faulty or in need of maintenance commence repair/replacement operations. (in consultation with the UIC Program Director restart injection).	Minor	Site Operator	Maintenance	Site Operator		Open	
											Mitigation	Vent fluids, if needed to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director)	Major/Serious	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Eng/Site Operator	Monitoring	Well Eng	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, initiate shutdown plan. Provided there is sufficient mechanical intergrity to contain pressures. May need to allow Packer fluid into reservoir and keep well full with fluid in mechanical integrity permits.	Minor	Well Eng/Site Operator	Monitoring	Well Eng	Workover rig to pull tubing if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Well Eng., Project Mgr.	Monitoring/Maintenance	Well Eng., Project Mgr.		Open	
2b		SLB	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Annulus pressure indicates a loss of external or internal well containment.	Equipment	HS	Low	Serious	X (Likelihood: Low; Severity: Serious)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	2b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.		Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well or USDW. Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid if required.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline, Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids, if needed, to maintain reasonable wellbore and surface facilities pressures.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project M	Monitoring	Well Engineer		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished May include plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if requ	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Site Operator	Monitoring/Maintenance	Site Operator		Open	
2c		SLB	Injecting/Monitoring	Injection or monitoring (verification) well integrity failure	1. Mechanical integrity test results identify a loss of mechanical integrity.	Equipment	HS	Very Low	Catastrophic	X (Likelihood: Very Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	2c
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.		Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). After verifying pressures will not damage well or USDW Need to verify best method to shut in well so that the mechanical integrity issues are not a factor such as allowing packer fluid to flow to reservoir and keep well full of liquid.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline logs, workover rig	Open	
											Mitigation	Vent fluids if needed, to maintain reasonable wellbore and surface facilities pressures.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr.	Monitoring	Well Engineer		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished May include plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	
											Mitigation	If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components. electrical malfunctions without endangering a USDW, repair faulty components. Verify with analog gauges.	Minor	Site Operator	Monitoring/Maintenance	Site Operator		Open	
3a		SLB	Injecting/Monitoring	Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.)	1. The failure of monitoring equipment for wellhead pressure, temperature, and/or annulus pressure may indicate a problem with the injection well that could endanger USDWs.	Equipment	HS	Medium	Light	X (Likelihood: Medium; Severity: Light)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	3a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid if required.	Major/Serious	Site Operator	Monitoring	Site Operator	Wireline, Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids, if needed, to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Verify pressures and temperatures with analog guages.							
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr.	Monitoring	Well Engineer, Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. Mayinclude plugs.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	
3b		SLB	Injecting/Monitoring	Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.)	1. Equipment failures (sensor, computer, cabling, etc) and damage to wellhead (ran over by heavy equipment)	Equipment	HS	Very Low	Catastrophic	X (Likelihood: Very Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	3b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Project Mgr.	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Shut in well (close flow valve). Allow packer fluid into reservoir to stop CO2 flow and keep well full with proper density fluid.	Major/Serious	Site Operator	Monitoring	Site Operator	Workover rig to pull tubing if required	Open	
											Mitigation	Vent fluids f from wellhead in order to maintain acceptable pressures as surface and downhole as not to damage the wellhead or casing, if possible	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director).	Major/Serious	Well Engineer, Project Mgr.	Monitoring	Well Engineer, Project Mgr.		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	If there has been a loss of mechanical integrity, prepare well for longer term shutdown to get repairs accomplished. Mayinclude plugs	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig to set plugs if required	Open	
											Mitigation	Reset automatic shutdown devices.	Minor	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs, workover rig	Open	
											Mitigation	If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased.	Minor	Well Engineer	Monitoring	Well Engineer	Workover rig	Open	
											Mitigation	Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).	Minor	Well Engineer	Monitoring	Well Engineer	Wireline logs	Open	
											Mitigation	Review downhole, wellhead, and annulus pressure data.	Major/Serious	Well Engineer	Monitoring	Well Engineer		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Hand-held air quality monitor	Open	
											Mitigation	Perform a well log/MIT to detect CO2 movement outside of the casing.	Major/Serious	Well Engineer	Monitoring	Well Engineer	Well log/MIT	Open	
4a		SLB	Throughout	Fluid (e.g. brine) leakage to a USDW	1. Any evidence of fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality, and CO2 leakage to the land surface.	Leakage	Environmental	Very Low	Catastrophic	X (Likelihood: Very Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	4a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate shutdown of plant.	Major/Serious/Minor	Site Operator	Monitoring	Site Operator		Open	
												If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to:		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Remediate unacceptable impacts to the affected USDW.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or CO2or "pump and treat" to aerate CO2-laden water).	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Address a well integrity issue, including taking specific steps to identity the location of the failure/leak, affect repairs, and demonstrate M.	Major/Serious/Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious/Minor	Site Operator	Monitoring	Air monitoring	Hand-held air quality monitor	Open	
4b		SLB	Throughout	Fluid (e.g. CO2) leakage to a USDW	1. Any evidence of CO2 movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality, and CO2 leakage to the land surface.	Leakage	Environmental	Very Low	Catastrophic	X (Likelihood: Very Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	4b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Initiate shutdown plan.	Major/Serious/Minor	Site Operator	Monitoring	Site Operator		Open	
												If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Program Director) a case-specific work plan to		Site Operator	Monitoring	Project Mgr.		Open	
											Mitigation	Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact; and	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Remediate unacceptable impacts to the affected USDW.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Arrange for an alternate potable water supply, if the USDW was being utilized and has been caused to exceed drinking water standards.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Proceed with efforts to remediate USDW to mitigate any unsafe conditions (e.g., install system to intercept/extract brine or CO2or "pump and treat" to aerate CO2-laden water).	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Clean Energy Systems and the UIC Program Director) until unacceptable adverse USDW impact has been fully addressed.	Major/Serious/Minor	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	Address a well integrity issue, including taking specific steps to identity the location of the failure/leak, affect repairs, and demonstrate M.	Major/Serious/Minor	Well Eng., Project Mgr.	Monitoring	Well Eng., Project Mgr.		Open	
											Mitigation	Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.	Major/Serious/Minor	Site Operator	Fence	Air montoring	Hand-held air quality monitor	Open	
5a		SLB	Throughout	A natural disaster (e.g., earthquake, tornado, lightning strike)	1. Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. An earthquake may disturb surface and/or subsurface facilities; and weather-related disasters (e.g., tornado or lightning strike) may affect surface facilities.	Natural	Environmental	Low	Catastrophic	X (Likelihood: Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	5a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Initiate immediate shutdown plan.	Major/Serious	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Shut in well (close flow valve).	Major/Serious/Minor	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Vent CO2 from surface facilities if appropriate.	Major/Serious/Minor	Site Operator	Preventative Operation	Site Operator		Open	
											Mitigation	Communicate with CES personnel and local authorities to initiate evacuation plans, as necessary.	Major/Serious	Site Operator	Monitoring			Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Major/Serious		Monitoring			Open	
											Mitigation	Determine if any leaks to ground water or surface water occurred.	Major/Serious	GW Consultant	Monitoring	GW Consultant		Open	
											Mitigation	If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Program Director)	Major/Serious	GW Consultant	Remedial Action	GW Consultant		Open	
											Mitigation	Conduct assessment to determine whether there has been a loss of mechanical integrity.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	If there has been a loss of mechanical integrity, initiate shutdown plan.	Minor	Site Operator	Remedial Action	Site Operator		Open	
											Mitigation	If there has not been a loss of mechanical integrity, initiate gradual shutdowr	Minor	Site Operator	Remedial Action	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify integrity loss and determine the cause and extent of failure; identify and implement appropriate remedial actions to repair damage to the well (in consultation with the UIC Program Director).	Minor	Site Operator	Monitoring	Site Operator		Open	
6a		SLB	Throughout or injection	Induced or natural seismic event	1. Injection operation inducing a seismic event equal to or less than M1.5	Seismic	Environmental	Medium	Light	X (Likelihood: Medium; Severity: Light)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6a
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Continue normal operation within permitted levels	Minor	Site Operator		Site Operator		Open	
											Mitigation	Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	
6b		SLB	Throughout or injection	Induced or natural seismic event	1. Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0	Seismic	Environmental	Medium	Light	X (Likelihood: Medium; Severity: Light)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6b
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
											Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
												Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
												Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
												Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	
6c		SLB	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M1.5 and local observation or felt report.	Seismic	Environmental	Medium	Major	X (Likelihood: Medium; Severity: Major)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6c
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
											Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
												Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
												Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
												Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	
6c		SLB	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0 and no felt report	Seismic	Environmental	Low	Light	X (Likelihood: Low; Severity: Light)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6c
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Continue normal operation within permitted levels.	Minor	Site Operator		Site Operator		Open	
											Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate.	Minor	Site Operator		Site Operator		Open	
												Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.	Minor	Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
												Report findings to the UIC Program Director and issue corrective actions.	Minor	Site Operator		Site Operator		Open	
												Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	
6d		SLB	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0 and local observation or report	Seismic	Environmental	Low	Major	X (Likelihood: Low; Severity: Major)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6d
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Initiate gradual shutdown of the well if it is determined to be appropriate	Minor	Site Operator		Site Operator		Open	
											Mitigation	Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.	Minor	Site Operator	Monitoring	Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC	Minor	Site Operator		Site Operator		Open	
											Mitigation	Determine if leaks to ground water or surface water or a CO2 leak to the surface occurred.	Major/Serious	GW Consultant		GW Consultant		Open	
											Mitigation	If a CO2 leak or USDW contamination/endangerment is detected. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director.		Site Operator		Site Operator		Open	
											Mitigation	Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.		Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
											Mitigation	Report findings to the UIC Program Director and issue corrective actions.		Site Operator		Site Operator		Open	
												Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	
6e		SLB	Throughout or injection	Induced or natural seismic event	1. Seismic event greater than M2.0, and local observation or report, andlocal report and confirmation of damage . 2. Seismic event >M3.5	Seismic	Environmental	Low	Catastrophic	X (Likelihood: Low; Severity: Catastrophic)		Limit access to wellhead to authorized personnel only.		Site Operator	Signage	Site Operator		Open	6e
											Mitigation	Determine the severity of the event, based on the information available, within 24 hours of notification.		Site Operator		Site Operator		Open	
											Mitigation	Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c).	Major/Serious, Minor	Site Operator		Site Operator		Open	
											Mitigation	Initiate immediate shutdown plan	Minor	Site Operator		Site Operator		Open	
											Mitigation	Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary.	Minor	Site Operator		Site Operator		Open	
											Mitigation	Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC	Minor	Site Operator		Site Operator		Open	
											Mitigation	Determine if leaks to ground water or surface water or a CO2 leak to the surface occurred.	Major/Serious	GW Consultant		GW Consultant		Open	
											Mitigation	If a CO2 leak or USDW contamination/endangerment is detected. Notify the UIC Program Director within 24 hours of the determination and implement appropriate remedial actions in consultations with the Director.		Site Operator		Site Operator		Open	
											Mitigation	Review seismic and operational data to determine location and magnitude of seismic event. If the event falls within or near the extents of the plume, use the microseismic, geomechanics and facies data to estimate potential impact to USDWs. Perform a pressure fall-off test to determine if the storage complex has been compromised by the seismic event.		Microseismic provider		Site Operator	Microseismic monitoring, fall-off test	Open	
											Mitigation	Report findings to the UIC Program Director and issue corrective actions.		Site Operator		Site Operator		Open	
												Document the event for reporting to EPA in semiannual reports.	Minor	Site Operator		Site Operator/Micoseimic Provider	Microseismic monitoring	Open	

ENCLOSURE 2

Evaluation of Financial Responsibility Demonstration Provided for the CES-Mendota Class VI Site

This financial responsibility demonstration evaluation report for the proposed Clean Energy Systems (CES)-Mendota Class VI geologic sequestration project summarizes EPA's evaluation of the cost estimates provided in Attachment H of the CES-Mendota Class VI permit application. Pursuant to 40 CFR 146.85, Class VI permit applicants must demonstrate financial responsibility (FR) for performing corrective action on deficient wells in the area of review (AoR), plugging the injection well, postinjection site care (PISC) and site closure, and emergency and remedial response (E&RR). To make this demonstration, they must 1) estimate the cost of each of these activities, and 2) provide qualifying financial instruments.

CES is still working to update cost estimates for the identified FR activities and subsequently secure qualifying financial instruments. So, preliminary responses only are provided herein. CES expects to complete its estimates in the fourth quarter of 2020 and resubmit FR documentation at that time. We appreciate your understanding and willingness to work with us on this matter.

This Enclosure has been abbreviated to only contain preliminary responses to EPA's Questions/Requests and Future Considerations.

PART 1: Cost Estimate Evaluation

Questions/Requests for CES:

- *It appears that CES's cost estimates were generated using the EPA FR Cost Estimation Tool; if this is the case, can CES confirm that all of the activities planned for post-injection site care and site closure, and emergency response are addressed in the cost estimate? (It is assumed that corrective action and injection and monitoring well plugging activities will be similar to the activities on which the Cost Tool assumptions are based.)*

Yes, the cost estimates submitted with Attachment H: Financial Assurance Demonstration were generated using the EPA FR Cost Estimation Tool. To the best of our knowledge, it included all planned activities for post-injection site care, site closure, and potential emergency responses.

- *The cost estimates should represent costs for an independent third party to perform each activity (i.e., not a "discounted" rate provided to CES or its consultants). Please confirm that the cost estimates provided are for an independent third party to conduct the activities described in the corrective action, plugging, post-injection site care and site closure, and emergency and remedial response plans of the permit application. Alternatively, if the estimates provided do not represent costs for an independent third party to conduct these activities, please revise and re-submit the estimates accordingly.*

CES is working with Schlumberger to develop updated the cost estimates for the identified FR activities: performing corrective action on deficient wells in the area of review (AoR), plugging the injection well, post¬injection site care

(PISC) and site closure, and emergency and remedial response (E&RR). Data is being gathered from third parties and Schlumberger Oilfield Services for actual 2020 costs for several items. The cost estimates represent competitive quotes for the services listed, where applicable; i.e. not a "discounted" rate. Once complete, CES will updated and re-submit the estimates accordingly.

- *Please provide the date of the cost estimate and revise the cost estimates to reflect current year (i.e., 2020) dollars.*

Updated cost estimates are being developed based upon the current year and will be provided in 2020 USD.

Future Considerations Based on the Results of Pre-Operational Testing/Modeling Updates:

- *Confirm assumptions about the depth and diameters of the injection well and monitoring wells based on final plans/as-built specifications.*

The current plan provides the best estimate based upon available information. As additional site-specific information is acquired, plans/assumptions will be updated accordingly. As built specifications will be completed when the well is drilled.

- *Changes to various Cost Tool inputs (e.g., the size of the AoR based on final modeling, the total volume of CO_2 to be injected, corrective action needs at the time the permit is issued, and the approved post-injection site care timeframe) will affect the estimates generated by the Cost Tool.*

Understood. Outputs from the Cost Tool can be recalculated once information is acquired based on the key site-specific data.

- *Although CES provided ranges of cost estimates, the selected financial instrument(s) (see Part 2 below) will need to have a specific face value that is proposed to, and approved by, EPA.*

Understood. Once updated cost estimates are complete, CES will secure appropriate financial instruments with a set value and submit to EPA for approval. Cost estimates, and potentially the value of the associated financial instrument, may be updated once key site-specific information is acquired.

PART 2: Financial Instrument Demonstration

CES plans to use a single financial instrument to cover the costs of corrective action, injection well plugging, PISC and site closure, and emergency and remedial response. Financial instruments that CES identifies as under consideration include a trust agreement, escrow agreement, or certificate of insurance.

CES must provide acceptable FR instrument(s) listed under 40 CFR 146.85(a)(1) prior to the issuance of a permit for the construction of a new Class VI well. If CES elects to use a trust fund or escrow account, the EPA Director may allow phased pay-in for these two instruments. However, CES must submit a pay- in schedule for the Director's review and approval.

CES is still in the process of evaluating and securing acceptable financial instruments to support Class VI well FR. Currently, CES is considering multiple instruments including surety bonds, letter of credit, certificate of insurance, corporate guarantees, escrow account and/or trust fund. CES may elect to use more than one financial instrument

to meet the required FR demonstration. Also, based upon the project timeline, CES may implement the selected instruments at different stages of the Project and/or utilize a phased pay-in (trust fund or escrow account). We would like to work with the EPA to ensure the selected instruments and their implementation meet the requirements of the 40 CFR 146.85.

As an indication of our progress, a Letter of Support from an insurance provided is included in the Appendix. However, feedback from discussions with multiple insurance companies has indicated that no insurance policy for CCS projects yet exists. Generally, the market appears to still be in the process of evaluating risks and developing policies for CCS projects - though no guarantee has been made that such policies will be offered.

Appendix

New Energy Risk, Inc., Letter of Support for Financial Assurance for Class VI UIC Permit for Clean Energy Systems Carbon Capture Projects

NEW ENERGY RISK
The Power Of Certainty™

March 13, 2020

Clean Energy Systems Inc.
3035 Prospect Park Drive
Rancho Cordova, CA 95670

United States Environmental Protection Agency,

Re: FINANCIAL ASSURANCE FOR CLASS VI UIC PERMIT

It is our pleasure to share our work with Clean Energy Systems (CES) and their partner, Schlumberger, to enable several aspects of their planned projects utilizing bioenergy and carbon capture, including insurance coverages to protect their innovative process equipment above the surface as well as meet their financial assurance responsibilities in the sub-surface.

New Energy Risk is a Managing General Underwriter, and subsidiary of AXA XL, a global insurer and reinsurer which maintains an investment-grade financial strength rating of S&P "AA-". In addition to AXA XL, New Energy Risk maintains strategic relationships with many global reinsurers, from which New Energy Risk can draw capacity. New Energy Risk has a proven track record, providing $1B+ in insurance capacity to innovative clean energy projects in the US and around the world which facilitated $2B+ in overall capital spending.

New Energy Risk is working with CES and Schlumberger to use our global network of insurers to more cost-effectively meet their financial assurance requirements for their Class VI UIC application than the presumed alternative, a fully-funded trust.

As carbon capture and storage is still a nascent industry in the US and the associated Class VI UIC permits are still rare, New Energy Risk does not have a product "off the shelf" to meet the US EPA's UIC requirements. However, we are actively working with our industry partners to structure a solution that meets US EPA's expectations. We welcome US EPA's advice and input as we structure this solution which we hope will facilitate growth in the domestic carbon capture industry and increase the number of granted Class VI UIC permits.

Though in the past we have never failed to secure capacity, New Energy Risk cannot guarantee that we will be successful in structuring performance insurance for the project, and AXA XL cannot offer any such performance insurance until our full diligence has been completed and the policy has been approved and issued by AXA XL. Until then, we are very excited to continue our analysis and create an insurance solution that meet's US EPA's requirements. Please contact me at mlucas@newenergyrisk.com should you have any questions.

Yours truly,

Matt Lucas

Matt Lucas, PhD
Managing Director, Business Development
Mobile: +1 (703) 201-5542